1989/BC3)

$f(x) = e^x \cos x$ on $[0, 2\pi]$

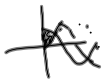
a) abs max/min

$f'(x) = e^x \cos x + e^x(-\sin x)$

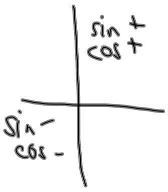
$= e^x(\cos x - \sin x)$ +1

rel min/max

$f'(x) = 0 \Rightarrow e^x(\cos x - \sin x) = 0$



$\therefore \cos x - \sin x = 0$



$\cos x = \sin x$

$1 = \frac{\sin x}{\cos x} = \tan x$

sign chart of f'

$\therefore x = \frac{\pi}{4}, \frac{5\pi}{4}$

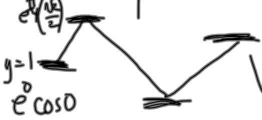
5.5

+ + | − − − − | + + +

0 $\frac{\pi}{4}$ $\frac{5\pi}{4}$ 2π

rel max at $\frac{\pi}{4}$

rel min at $\frac{5\pi}{4}$ that is abs min



$e^0 \cos 0$

$y = e^{2\pi}(\cos(2\pi))$

$e^{\frac{5\pi}{4}} \cos\left(\frac{5\pi}{4}\right)$

$e^x \cos x$ 5pts $e^{\frac{5\pi}{4}}\left(-\frac{\sqrt{2}}{2}\right)$ $= e^{2\pi}$ abs max at $x = 2\pi$

b) $f(x)$ inc: $\left[0, \frac{\pi}{4}\right] \cup \left[\frac{5\pi}{4}, 2\pi\right]$

2pts

c) $f'(x) = e^x(\cos x - \sin x)$

$f''(x) = e^x(\cos x - \sin x) + (e^x)(-\sin x - \cos x)$

$= e^x(-2\sin x)$ +1

sign chart of f''

− − − | + + +

0 π 2π

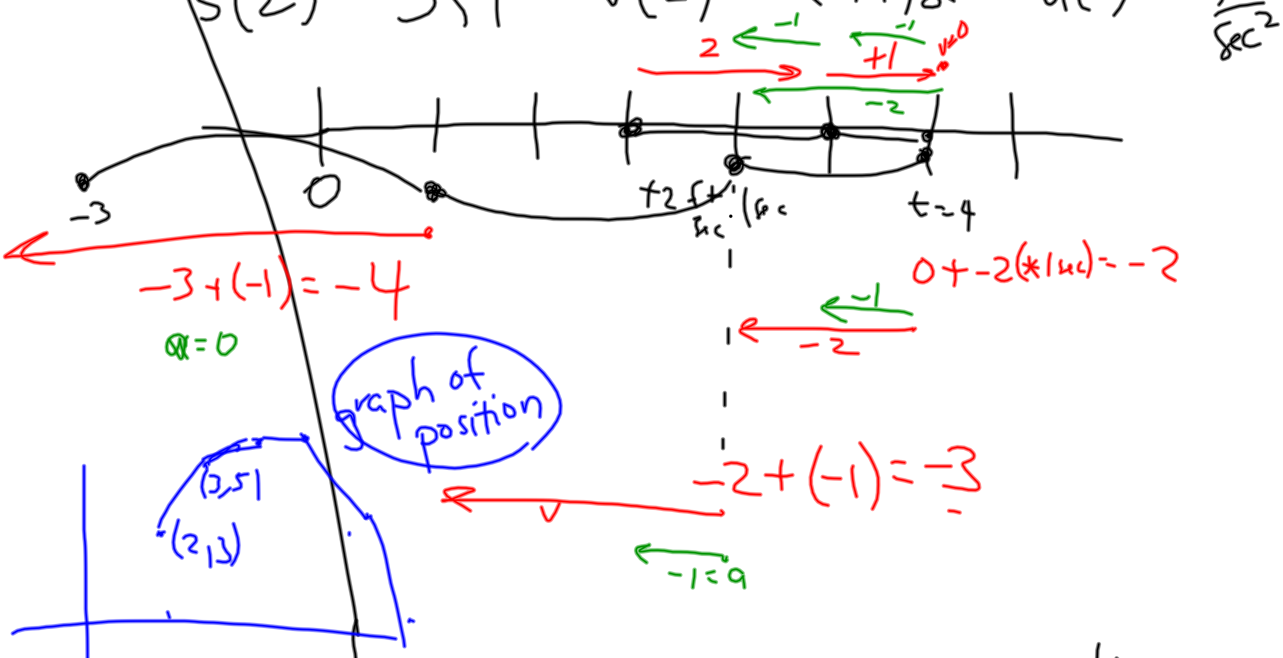
$f''=0$

+1

$x = \pi$ is where pt of inflection occurs

[f chgs fr conc-dn to conc-up]

$s(2) = 3\text{ ft}$ $\quad v(2) = 2\text{ ft/sec}$ $\quad a(2) = -1\,\frac{\text{ft}}{\text{sec}^2}$



5.4 rectilinear motion

$x(t)$ is a position function

$v(t) = \frac{dx}{dt}$ Velocity is first derivative

$a(t) = v'(t) = x''(t)$

53/15 $y = x^2 - \frac{1}{x}$ $-.79$ $= \frac{x^3-1}{x} = 0 \Rightarrow x = 1$

$$y' = 2x + \frac{1}{x^2} = \frac{2x^3+1}{x^2}$$

und

$x = 0$

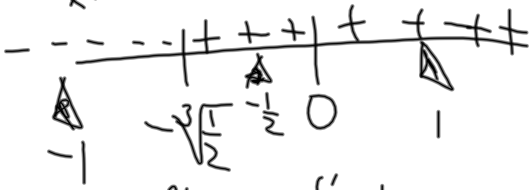
$= 0$

$2x^3 + 1 = 0$

$x^3 = -\frac{1}{2}$

$x = \sqrt[3]{-\frac{1}{2}} \approx -.790$

sign chart of $y' = \frac{2x^3+1}{x^2}$



$f' = 0$ rel. min

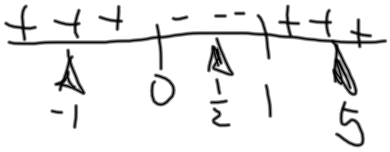
f' und

$$y' = 2x + \frac{1}{x^2} \qquad y'' = 2 - \frac{2}{x^3} = \frac{2x^3 - 2}{x^3}$$

$x^3 - 1 = 0$

$x = 1$

sign chart of y''



vert asym $x = 0$

no h. a.

rel min at $x = -\sqrt[3]{\frac{1}{2}}$

dec $(-\infty, -\sqrt[3]{\frac{1}{2}})$

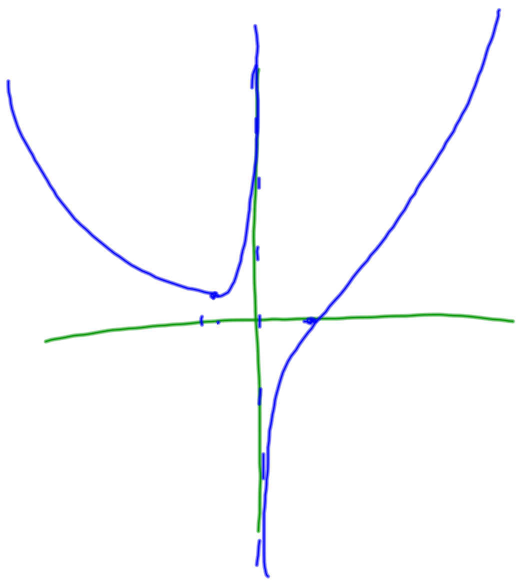
inc elsewhere

c-up $(-\infty, 0), (1, 5)$

c-dn $(0, 1)$

no y-int

x-int $x = 1$



19) $y = \dfrac{x-1}{x^2-4}$

$$y' = \frac{(1)(x^2-4)-(x-1)(2x)}{(x^2-4)^2}$$

$$= \frac{x^2-4-2x^2+2x}{(x^2-4)^2} = \frac{-x^2+2x-4}{(x^2-4)^2}$$

$$y'' = \frac{(-2x+2)(x^2-4)^2-(-x^2+2x-4)(2(x^2-4)(2x))}{((x^2-4)^2)^2}$$

$$= \frac{(x^2-4)\left[-2(x-1)(x^2-4)-4x(-x^2+2x-4)\right]}{(x^2-4)^4}$$

$$= \frac{(x^2-4)\left[-2(x^3-x^2-4x+4)+4x^3-8x^2+16x\right]}{(x^2-4)^4}$$

$$\frac{(x^2-4)\left[2x^3-6x^2+24x-8\right]}{(x^2-4)^4}$$

± 1

± 2

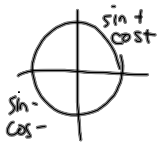
± 4

$$2(x^3-3x^2+12x-4)=0$$

1989/BC3 $\quad f(x) = e^x \cos x$ on $[0, 2\pi]$

a) abs max & min - - -

$$f'(x) = e^x \cos x + e^x(-\sin x) \quad +1$$

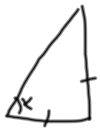


$$= e^x(\cos x - \sin x) = 0$$

$$\cos x - \sin x = 0$$

$$\cos x = \sin x$$

$$1 = \frac{\sin x}{\cos x} = \tan x$$



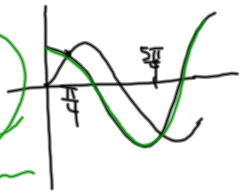
sign of $e^x(\cos x - \sin x)$ $\quad x = \frac{\pi}{4}, \frac{5\pi}{4}$ $\quad$ +1 each

+ + | - - - - | + + + +

$0 \qquad \frac{\pi}{4} \qquad \frac{5\pi}{4} \qquad 2\pi$

$e^{\pi/4}\left(\frac{\sqrt{2}}{2}\right)$? $\qquad$? $\quad e^{2\pi} \cdot \cos(2\pi) = e^{2\pi}$

$e^{5\pi/4}\left(\cos\frac{5\pi}{4}\right) = -$



$e^0(\cos 0)$

$y = 1$

rel min: $\frac{5\pi}{4}$

rel max: $\frac{\pi}{4}$

5.5

+1 abs min: @ $\frac{5\pi}{4}$. (15) $\boxed{e^{\frac{5\pi}{4}} \cdot \cos\left(\frac{5\pi}{4}\right)}$

+1 abs max @ $x = 2\pi$ (15) $e^{2\pi}$

(b) $\left[0, \frac{\pi}{4}\right]$ and $\left[\frac{5\pi}{4}, 2\pi\right]$

+1 $\qquad$ +1

(c) $f'(x) = e^x(\cos x - \sin x)$

(+1) $f''(x) = e^x(\cos x - \sin x) + e^x(-\sin x - \cos x)$

$$\to e^x(-2\sin x) = 0 \to \begin{cases} 0 \\ \pi \\ 2\pi \end{cases}$$

| - - - - | + + + + + |

$0 \qquad \pi \qquad 2\pi$

$s(2) = 3$ ft

$v(2) = 2$ ft/sec

$a(2) = -1$ ft/sec^2

$S(3) = 3\text{ft} + 2\frac{\text{ft}}{\text{sec}} \cdot 1\text{sec}$

$= 3+2 = 5$

$V(3) = 2\frac{\text{ft}}{\text{sec}} + \left(-1\frac{\text{ft}}{\text{sec}^2}\right) \cdot 1\text{sec}$

$= 2 + (-1) = 1\frac{\text{ft}}{\text{sec}}$

$a(3) = -1\frac{\text{ft}}{\text{sec}^2}$

$s(4) = 5\text{ft} + 1\frac{\text{ft}}{\text{sec}} \cdot 1\text{sec}$

$= 5+1 = 6$ ft

$V(4) = 1\text{ft/sec} + \left(-1\frac{\text{ft}}{\text{sec}^2}\right) \cdot 1\text{sec}$

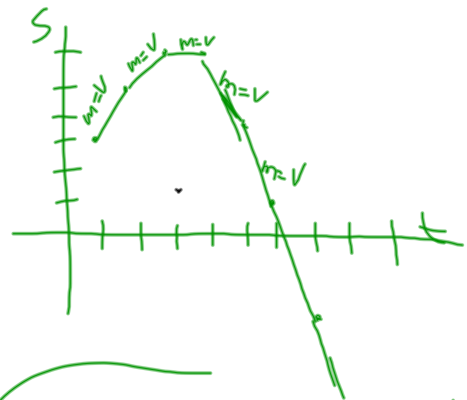
$= 1 + (-1) = 0\frac{\text{ft}}{\text{sec}}$

$a(4) = -2\frac{\text{ft}}{\text{sec}^2}$

$S_{new} = S_{OLD} + V_{OLD} * t$

$V_{new} = V_{old} + A_{OLD} * t$

t	s
2	3
3	5
4	6
5	6
6	4
7	1
8	-3
9	-7



5.4 rectilinear motion

$x(t)$ is a fn of position

$v(t) = x'(t)$ is velocity

$a(t) = v'(t) = x''(t)$ is acceleration